

## HL1 Mid-Year Final – Paper 2

Name \_\_\_\_\_

1.  $100\text{ cm}^3$  of ethene,  $\text{C}_2\text{H}_4$ , is burned in  $400\text{ cm}^3$  of oxygen, producing carbon dioxide and some liquid water. Some oxygen remains unreacted.

(a) Write the equation for the complete combustion of ethene.

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(2)

(b) Calculate the volume of carbon dioxide produced and the volume of oxygen remaining.

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(2)

(Total 4 marks)

2. Information about the halogens appears in the Data Booklet.

(i) Explain why the ionic radius of chlorine is less than that of sulfur.

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(2)

(ii) Explain what is meant by the term *electronegativity* and explain why the electronegativity of chlorine is greater than that of bromine.

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(3)

(Total 5 marks)

3. Draw the Lewis structures, state the shapes and predict the bond angles for the following species.

(i)  $\text{PCl}_5$

(3)

(ii)  $\text{SCl}_2$

(3)

(iii)  $\text{ICl}_4^-$

(3)

(Total 9 marks)

4. 0.502 g of an alkali metal sulfate is dissolved in water and excess barium chloride solution,  $\text{BaCl}_2(\text{aq})$  is added to precipitate all the sulfate ions as barium sulfate,  $\text{BaSO}_4(\text{s})$ . The precipitate is filtered and dried and weighs 0.672 g.

(a) Calculate the amount (in mol) of barium sulfate formed.

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(2)

- (b) Determine the amount (in mol) of the alkali metal sulfate present.

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(1)

- (c) Determine the molar mass of the alkali metal sulfate and state its units.

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(2)

- (d) Deduce the identity of the alkali metal, showing your workings.

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(2)

- (e) Write an equation for the precipitation reaction, including state symbols.

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(2)

(Total 9 marks)

5. Two characteristics of the d-block (transition) elements are that they exhibit variable oxidation states and form coloured compounds.

- (i) State **two** possible oxidation states for iron and explain these in terms of electron arrangements.

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(2)

- (ii) Explain why many compounds of d-block (transition) elements are coloured.

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(3)

(Total 5 marks)

6. (i) State the full electron configuration for argon.

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(1)

- (ii) Give the formulas of **two** oppositely charged ions which have the same electron configuration as argon.

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(2)

(Total 3 marks)

7. An organic compound A contains 62.0% by mass of carbon, 24.1% by mass of nitrogen, the remainder being hydrogen.

- (i) Determine the percentage by mass of hydrogen and the empirical formula of A.

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(3)

- (ii) Define the term *relative molecular mass*.

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(2)

- (iii) The relative molecular mass of A is 116. Determine the molecular formula of A.

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(1)

(Total 6 marks)

**Problems 8 & 9 are on here for review (when we get back from break). They are NOT graded, they are NOT extra credit, do not waste your time ☺ The giant "X" means stay away!!!!**

8. (a) List the following types of electromagnetic radiation in order of **increasing** wavelength (shortest first).

I. Yellow light

II. Red light

III. Infrared radiation

IV. Ultraviolet radiation

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(1)

- (b) Distinguish between a continuous spectrum and a line spectrum.

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- (c) The thinning of the ozone layer increases the amount of UV-B radiation that reaches the Earth's surface.

Type of Radiation	Wavelength / nm
UV-A	320–380
UV-B	290–320

Based on the information in the table above explain why UV-B rays are more dangerous than UV-A.

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(3)

(Total 5 marks)

9. (i) Crocetin consists of the elements carbon, hydrogen and oxygen. Determine the empirical formula of crocetin, if 1.00 g of crocetin forms 2.68 g of carbon dioxide and 0.657 g of water when it undergoes complete combustion.

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(6)

- (ii) Determine the molecular formula of crocetin given that 0.300 mole of crocetin has a mass of 98.5 g

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(2)

(Total 8 marks)